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**METHOD AND APPARATUS FOR AUTOMOTIVE RADIO TIME SHIFTING
PERSONALIZED TO MULTIPLE DRIVERS**

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BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates to a vehicle onboard computer system for controlling various vehicle onboard systems and subsystems. More specifically, the present invention relates to a system and method for implementing user specific preferences on the vehicle onboard computer system for regulating the operation of a vehicle audio subsystem. Still more particularly, the present invention relates to a system and method for identifying and authorizing users and implementing user specific parameters associated with the users with respect to the storing and playback of broadcast events.

20 **2. Description of Related Art:**

It has been well known in prior art to limit the access and operation of a vehicle by granting authority of the user to operate a vehicle with such devices as a mechanical key. In the prior art, any person who obtained the mechanical key could generally operate the vehicle.

As the sophistication and comfort of the vehicles increased, the number of vehicle systems and subsystems increased proportionally. The audio subsystem of a

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vehicle provides the vehicle operator with entertainment that eases the boredom associated with the mundane routine of operating the vehicle. In addition, news, traffic and weather broadcasts allow the user to better

5 plan a safer and more efficient route. One problem associated with prior art audio subsystems is that the audio preferences are not indexed by user. Other problems are that the user might not be aware of the exact broadcast time of a broadcast event or the user
10 might be preoccupied with operating the vehicle and unable to tune the audio receiver to the broadcast frequency. Therefore, it would be advantageous to have an improved method and apparatus for adjusting user specific preferences for recording and playback of
15 broadcast events in a vehicle.

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SUMMARY OF THE INVENTION

5 A plurality of users each selects desired listening broadcast programs that are recorded by a system in a memory and indexed to the specific user. The user may also select the desired playback schedule and playback format. Conveniently, the system retrieves recorded
10 broadcast programs stored in memory, then plays them according to the specific user's desired format and schedule. Additionally, each user may select which broadcast programs are stored, which broadcast frequencies are scanned by the system for the desired
15 broadcast programs, and how long each broadcast program is stored in memory.

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BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the
5 invention are set forth in the appended claims. The
invention itself, however, as well as a preferred mode of
use, further objectives and advantages thereof, will best
be understood by reference to the following detailed
description of an illustrative embodiment when read in
10 conjunction with the accompanying drawings wherein:

Figure 1 depicts a block diagram illustrating a data
processing system of the present invention.

Figure 2 depicts onboard systems of the present
invention as defined in a preferred embodiment of the
15 present invention.

Figure 3 illustrates the suspension and ride system
of the vehicle.

Figure 4 illustrates the comfort system of the
vehicle.

20 **Figure 5** illustrates another system under the
control of the onboard computer, the
communications/interface system.

Figure 6 illustrates another system under the
control of the onboard computer, the navigation and
25 tracking system.

Figure 7 illustrates another system under the
control of the onboard computer, the audio system.

Figure 8 illustrates the safety system as
implemented in the present invention.

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Figure 9 illustrates the engine performance system as related to the present invention.

Figure 10 illustrates the user interface system as implemented in the present invention.

5 **Figure 11** depicts another embodiment of Audio system 700 as defined by the present invention.

Figure 12 depicts the process of the present invention.

10 **Figures 13A** and **13B** illustrate the playback mode of the present invention.

Figure 13B illustrates the playback mode of the present invention in more detail.

Figure 14 illustrate the data structure stored in memory of the present invention.

15 **Figure 15** illustrates the user ID data structure.

Figure 16 illustrates the verification data structure.

Figure 17 illustrates the security level data structure.

20 **Figure 18** illustrates an extremely abbreviated data structure of possible preferences.

Figure 19 illustrates the preference limits data structure.

25 **Figure 20** illustrates the data structure of user logged data.

Figure 21 illustrates an example of how the onboard computer authorizes user preferences by user security level.

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Figure 22 illustrates an example of a set of user specific preferences for the audio system.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5 The present invention provides for a method and means for implementing user specific preferences to onboard systems on a vehicle. Heretofore user specific preferences were unknown because the onboard systems could not discriminate between users' identities but would
10 instead discriminate between access keys, either mechanical or personal identification numbers. The present invention incorporates user verification for positively verifying the user and indexing user specific preferences to that user whereby the user need not make
15 adjustments to the various onboard systems each time the user accesses the vehicle. The present invention is described herein with reference to a preferred embodiment of the onboard systems (**Figures 1 to 11**), a process for practicing the present invention implemented on the
20 onboard system (**Figures 12 and 13**) and finally, with respect to an embodiment of a data structure used in conjunction with the process (**Figures 14 to 22**).

With reference now to **Figure 1**, a block diagram illustrates a data processing system in which the present
25 invention may be implemented. Data Processing system **100** is an example of a client computer. Data Processing system **100** employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus architectures such as

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Micro Channel and ISA may be used. Processor **102** and Main Memory **104** are connected to PCI local Bus **106** through Host/PCI Cache/Bridge **108**. Host/PCI Cache/Bridge **108** also may include an integrated memory controller and cache 5 memory for Processor **102**. Additional connections to PCI local Bus **106** may be made through direct component interconnection or through add-in boards. In the depicted example, Local Area Network (LAN) Adapter **110**, SCSI Host Bus Adapter **112**, and Expansion Bus Interface **114** are 10 connected to PCI local Bus **106** by direct component connection. In contrast, Audio Adapter **116**, Graphics Adapter **118**, and Audio/Video Adapter (A/V) **119** are connected to PCI local Bus **106** by add-in boards inserted 15 into expansion slots. Expansion Bus Interface **114** provides a connection for a Keyboard and Mouse Adapter **120**, Modem **122**, and additional Memory **124**. Additional Memory **124** may consist of any type of memory including flash memory. SCSI Host Bus Adapter **112** provides a connection for hard Disk drive **126**, Tape drive **128**, and 20 CD-ROM drive **130**. Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

An operating system runs on Processor **102** and is used to coordinate and provide control of various components 25 within Data Processing system **100** in **Figure 1**. The operating system may be a commercially available operating system such as OS/2, which is available from International Business Machines Corporation. "OS/2" is a trademark of International Business Machines Corporation. The

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operating system may also be a real time operating system (RTOS), such as QNX Neutrino™ from QNX Software Systems Ltd., 175 Terranence Matthews Crescent, Kanata, Ontario, Canada K2MLW8. An object oriented programming system such 5 as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on Data Processing system **100** via a Java Virtual Machine. "Java" is a trademark of Sun Microsystems, Inc. Instructions for the 10 operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard Disk drive **126**, and may be loaded into Main Memory **104** for execution by Processor **102**.

Those of ordinary skill in the art will appreciate 15 that the hardware in **Figure 1** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in 20 **Figure 1**. Also, the processes of the present invention may be applied to a multiprocessor data processing system.

For example, Data Processing system **100**, if 25 optionally configured as a network computer, may not include SCSI Host Bus Adapter **112**, hard Disk drive **126**, Tape drive **128**, and CD-ROM **130**, as noted by dotted line **132** in **Figure 1** denoting optional inclusion. In that case, the computer, to be properly called a client computer, must include some type of network communication

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interface, such as LAN Adapter **110**, Modem **122**, or the like. For mobile vehicle applications, the preferred network communication interface might be a wireless network circuit for communicating digital packets of information to and from the central fleet server. As another example, Data Processing system **100** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not Data Processing system **100** comprises some type of network communication interface. As a further example, Data Processing system **100** may be a Personal Digital Assistant (PDA) device which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 1** and above-described examples are not meant to imply architectural limitations with respect to the present invention. Although **Figure 1** provides examples of configurations of computer systems on which the present invention may execute, the following background information may provide a context for understanding the overall computing environment in which the present invention may be used.

Figure 2 describes the systems of the present invention as defined in a preferred embodiment of the present invention. In the present invention, the vehicle may contain one or more Onboard Computer(s) **20**. Users control different systems within the vehicle through Onboard Computer **20**. A specific user can only gain as

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much control of a system or subsystem as authorized by Onboard Computer **20**. A user may fall into one or more security level(s), for instance, low level security, master level security, administrator, service attendant, 5 parking attendant or semi-user. The varying levels of security allow users having different access priorities to access only the systems authorized by the level of security that corresponds to the user's security level. Other, more specialized security levels might also be 10 available for special purpose operation of the vehicle, such as thief and drunk driver levels which severely limit access and performance of the vehicle.

Implementing the different security levels is primarily a software function which authorizes security 15 levels in a series of IF tests in a logic flow. This software function is an extremely effective means of implementing security levels because the preferred embodiment consists of a closed system which is protected from arbitrary software being installed from unknown 20 sources. Alternatively, each security level could be a separate level of hardware. Onboard Computer **20** also contains an onboard computer Memory **22** which would store the software logic described above. Onboard Computer system **20** is intended to be exemplary in nature, and it 25 is not intended in any way to restrict the implementation of this invention.

In one embodiment of this invention, Onboard Computer **20** controls several onboard systems through its different security levels. For simplicity, the invention

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is described largely as consisting of two security levels, low and high, corresponding to two different levels of user security. One feature of this invention is that accessing and changing preferences relating to 5 any one of these systems can be done only by the user who has a corresponding security level for the security level which controls the specific system.

Taking first the lower level security, a low level security user may access and change preference settings 10 for one or more of the following onboard systems: Suspension and Ride system **300**; Comfort system **400**; Communications/Interface system **500**; Navigation and Tracking system **600**; Audio system **700**; and Systems Monitoring system **290** for the above-mentioned onboard 15 systems.

A user possessing a higher security level, such as a master security level as authorized by Onboard Computer **20**, in addition to resetting and adjusting the preference settings for the systems requiring a lower level security 20 level for access, may also adjust the preference settings of the systems requiring a higher level of security for authorization. Higher level security authorization is required for: Safety system **800**; Engine Performance system **900**; and Theft Deterrence and Recovery system **210**.

25 **Figure 3** depicts the suspension and ride system of the vehicle. The dashed line around the subsystems depicts which functions are controlled by the system. Suspension and Ride system **300** and associated subsystems are controlled by preferences which set functions

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associated with the particular subsystems. Suspension and Ride system **300** includes Suspension Performance Tuning **350**. By the user specifying suspension performance tuning parameters, the vehicle's ride attributes, such as pitch, yaw, roll and stiffness, can be changed.

As the user is identified through the use of a user ID via User Interface **28**, Onboard Computer **20** extracts certain performance settings from onboard Memory **22** which are indexed to the user's name or ID number. These performance settings include user specific parameters which are used to modify each of the functions described above. One example is that a user may prefer a stiffer ride and may prefer a certain feel when he operates the vehicle. Therefore, the user may select certain parameters having to do with suspension performance tuning to affect the vehicle's ride. These parameters adjust each one of the functions mentioned above associated with the subsystem in order to give that user the ride which he desires.

Systems Monitoring **290** continually monitors pitch, yaw, roll and stiffness attributes of the vehicle's ride and transmits the information to Onboard Computer system **20**. In another embodiment of this invention, Systems Monitoring system **290** continually updates the suspension performance tuning in order to maintain that overall riding effect desired by the user. Therefore, as suspension and ride parts such as tires, shocks, struts, springs and bearings wear, Systems Monitoring system **290**

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monitors each one of the functions for the desired effect. If the results monitored by Systems Monitoring system **210** are not within the user's set preference, Onboard Computer system **20** may attempt to adjust each one 5 of the functions automatically in an attempt to adjust the ride to the user's desired preferences--in other words, reset the user specified ride parameters automatically.

In another embodiment, the user merely sets 10 parameters associated with suspension performance tuning, and Systems Monitoring system **290** merely monitors the functions and transfers the functional output to Onboard Computer **20**. In this embodiment, it is left up to the user to manually set each one of the ride and suspension 15 parameters, and as the parts of the vehicle change with respect to wear or damage, the user is expected to manually update each one of the parameters. Although this is possible, it is unlikely that the ordinary user would possess the skill necessary to make those 20 adjustments autonomously, thus requiring Onboard Computer **20** to calculate those functional parameters for the user. Therefore, while expert drivers such as race car drivers, mechanics and the like may possess the knowledge needed to adjust these parameters, the ordinary weekend vehicle 25 operator might rely on a routine stored within Onboard Computer **20** to make those adjustments.

Figure 4 illustrates another system under the control of every user, the Comfort system **400**. Comfort system **400** includes: Air Temperature and Flow subsystem

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410; Seats and Steering Wheel subsystem **420**; and Mirrors and Windows subsystem **430**. Once the user has been identified by Onboard Computer **20** via User Interface **28**, Onboard Computer **20** retrieves user specific parameters from system Memory **22**. Those user specific parameters are used to adjust the various subsystems of Comfort system **400**. If a user enjoys the air temperature somewhat lower and the flow higher than other users, as the user is identified by Onboard Computer **20**, Air Temperature and Flow subsystem **410** are automatically adjusted to the user specific parameters stored in Memory **22**. Therefore, the user would not have to readjust the air temperature and flow parameters every time the user enters the car, but rather merely satisfy identification to Onboard Computer **20**, and Onboard Computer **20** would retrieve the user's specific user parameters from Memory **22** and adjust Comfort system **400** accordingly.

In the depicted example, other conveniences controlled by Comfort system 400 include adjusting seats and steering wheel positions, and mirrors and windows for particular users. As the user's height and proportions tend to change from user to user, it would be advantageous for each user to preset such settings as the seat position setting and the steering wheel position, along with mirror positions and window positions for the individual user. As the user drives the vehicle, and climate conditions or tastes change, the user may have occasion to adjust certain of the above-mentioned subsystems. As the user adjusts the subsystems, Systems

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Monitoring system **290** notes these adjustments and transmits the adjustments to Onboard Computer **20**.

Onboard Computer **20** then may store the adjustments to system Memory **22**. On exiting the vehicle, the user need

5 not reset the various user parameters that were initially stored in Memory **22**, as these have been updated while the user operated the vehicle.

In one embodiment, Onboard Computer **20** merely retains the updated user specific parameters within

10 Memory **22** as the user exits the vehicle, retrieving them again as the user specific parameters when the user is again identified to Onboard Computer **20**. In another embodiment, updates fed to Onboard Computer **20** via Systems Monitoring system **290** are merely transient. In

15 that embodiment, the updates are lost once the user exits the vehicle unless the user takes some affirmative action to save them. In that embodiment, once the user exits the vehicle the updated parameters are lost in lieu of the initial user specific parameters.

20 **Figure 5** illustrates another system under the control of the onboard computer, the communications and interface system. Another system that may be under the control of lower level security users is Communications/Interface **500**. In a fully integrated

25 onboard computer system, the ability to access large amounts of data for the convenience and safety of the operator becomes more and more important. Also, as the complexity of vehicles increases, the maintenance of those vehicles is expedited by allowing access to Onboard

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Computer **20** and the various systems through a specialized maintenance interface.

One embodiment of the present invention, Communications/Interface system **500**, consists of various 5 subsystems as fulfill the various above-mentioned needs. These include: Satellite Com Link **510**; Cellular/PCS communications **520**; Personal Area Network Port **530**; Fleet Docking Port **540**; Maintenance Port **550**; Home Docking Port **560**; and Regulatory Docking Port **570**. Depending upon the 10 intended use of the vehicle, some or all of these communications subsystems may be eliminated or substituted with other types of communications subsystems.

Other subsystems, such as Satellite Com Link **510** and 15 Cellular/PCS communications **520** may contain extensive local memories for holding user specific data like earth link addresses and telephone numbers. Alternatively, earth link addresses and telephone numbers may be stored on a personal memory such as a SmartCard or magnetic 20 swipe card, or in system Memory **22**, and indexed by user.

In one example of the communications subsystems, for instance a fleet vehicle operation, vehicles could be continually tracked via Satellite Com Link **510**. The fleet dispatcher, therefore, could watch the progress of 25 vehicles and goods from the origin to the destination. If the dispatcher detects a delay somewhere along the route, the dispatcher could immediately contact the vehicle through Cellular/PCS **520** link or Satellite Com

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Link **510** to ascertain the problem and try to help the vehicle operator formulate an alternate route.

Personal Area Network (PAN) Port **530** would be useful for such things as ascertaining if a vehicle is

5 authorized to, for instance, go through a toll booth.

There, Onboard Computer **20** would automatically link with a computer at the toll booth via Personal Area Network Port **530** and communicate to the toll booth computer an electronic cash account number by which the toll computer

10 could access and debit the cash amount of the toll,

thereby eliminating the need for the driver of the vehicle to stop the vehicle and pay a toll. This would also eliminate the need for the driver to carry any cash while en route; and in fact, the vehicle itself may not

15 even need to have the cash account, as it could merely link to the home or fleet headquarters and debit a financial account for the cash.

Another interface particularly helpful in fleet operation is a Fleet Docking Port **540**. Although in the

20 preferred embodiment, Fleet Docking Port **540** is a

specific hardware port, fleet docking may also be realized by using the wireless network circuit described

above in reference to **Figure 1**. Fleet Docking Port **540**

would be useful for an operation that tracks several

25 vehicles up to several thousand vehicles. As the vehicle would enter the home terminal, the vehicle could park for transfer of cargo or maintenance, or whatever, and then

be linked via Fleet Docking Port **540** to the terminal

computer which in turn would be linked to the main

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operational computer. Thus, as the truck receives maintenance, or on or off loads cargo, the information concerning the prior trip could be downloaded from Onboard Computer **20** Memory **22**, and information pertaining

5 to the next scheduled trip, including maps, itinerary, electronic cash and the like, could be loaded onto Onboard Computer **20** Memory **22**. Vehicle operators could also be authorized and de-authorized for the vehicle.

As noted above, detailed maintenance records are
10 also important, especially as the number of vehicles in a fleet operation increases. Therefore, a specific Maintenance Port **550** would be useful. Maintenance Port **550** would provide instant access to certain files or records and allow for testing of onboard systems
15 simultaneously with other fleet interface operations.

While Maintenance Port **550** indicates that, primarily, the access is limited to maintenance of the engine and onboard systems and subsystems, Maintenance Port **550** should also have access to Onboard Computer **20** main
20 Memory **22** to ascertain such things as fuel and mileage logs, distances traveled, environments traveled in and the like. In this way, an expert mechanic could determine the overall maintenance condition of the unit by comparing it to its previous performance.

25 Home Docking Port **560** would also be useful in a fleet operation where the vehicle operator may be required to bring the vehicle home. In that case, the vehicle operator would merely dock the vehicle at the home port and, using the user's home computer, the fleet

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operations could interface with the computer, for instance while the operator was away or asleep or on another task. In this way, Memory **22** in Onboard Computer **20** could be uploaded with pertinent information about an 5 upcoming trip.

Figure 6 illustrates another system under the control of the onboard computer, the navigation and tracking system. Another important onboard system is Navigation and Tracking system **600**. A typical Navigation 10 and Tracking system **600** may include GPS **610** for ascertaining the exact vehicle position via geosynchronous positioned satellites. Maps and Databases **620** would probably reside in the system Memory **22**. Maps and Databases **620** might also be fairly transient, being 15 uploaded and downloaded as the intended route of the vehicle changes. In another aspect of the invention, Maps and Databases **620** may be downloaded via Satellite Com Link **510** or Cellular/PCS **520** connection to the vehicle's home terminal.

20 Navigation and Tracking system **600** may also include Locator Beacon **630**. While Locator Beacon **630** could take many forms and work in cooperation with one of the communication systems, either Satellite Com Link **510** or Cellular/PCS **520**, Locator Beacon **630** may be a separate 25 subsystem providing a radio frequency beacon used to locate the vehicle in case of emergency or possibly to track vehicle movements within a local area for a fleet dispatcher.

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Another important set of tracking databases might be Maintenance Log **640** and Driving Log **650**, which are somewhat related. For an expert mechanic to properly maintain a vehicle, it is useful to have within the 5 vehicle's Maintenance Log **640** the prior routes and conditions in which that vehicle was driven. In that way, when the vehicle experiences what appears to be a sudden loss in performance over the last few trips, a master mechanic can examine the log to note if any 10 difference in the driving pattern exists. Along that same vein, Driving Log **650** could also be useful to a master mechanic in examining the actual driving performance of the vehicle driver. Therefore, by carefully examining these two logs, a master mechanic 15 might merely conclude that what appears to be poor vehicle and engine performance can merely be attributed to the change in drivers, driving patterns or routes.

Additionally, Driving Log **640** and Maintenance Log **650** can be used together to assemble data in User Logged 20 Data **2000**, **Figure 20**. User logged data is indexed by user and might contain fields such as the operation of the vehicle, a specific trip and other data. The log could be displayed on User Interface **28** or at the user's 25 home terminal by a user having an administrator security level. User Logged Data **2000** is an extremely useful resource for setting preference limits as shown on data structure **1900**, **Figure 19**.

With User Logged Data **2000**, the performance of each user under a specific security level can be monitored by

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analyzing User Logged Data **2000**, and specific preferences can be set for that user. For instance, if a user appears to be prone to extremely fast accelerations, an administrator examining the Maximum Acceleration field of 5 User Logged Data **2000**, may limit that user. The administrator can limit vehicle acceleration to a more moderate rate by changing 5 feet per second² to 3.5 feet per second² in the Maximum Forward Acceleration field of Performance Limits data structure **1900**.

10 Working in close association with Navigation and Tracking system **600** would be Communications/Interface system **500** and especially Cellular/PCS subsystem **520**. Additionally, Theft Deterrence and Recovery system **210** and Collision Avoidance subsystem **870** of Safety system 15 **800** could also make extensive use of Navigation and Tracking system **600**.

In one example, if a vehicle is identified as being stolen or being used in an unauthorized manner, the vehicle can automatically ascertain its position via use 20 of GPS subsystem **610** and Maps and Databases subsystem **620**. Onboard Computer **20** could then use Communications/Interface system **500** to transmit the information through either Cellular/PCS subsystem **520** or Satellite Com Link subsystem **510** to the fleet dispatcher 25 or local authorities. Additionally, once it has been positively confirmed that the vehicle has been stolen, Locator Beacon **630** could be turned on to aid the police in determining the location of the vehicle.

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Another important feature of this invention, Safety system **800**, including Collision Avoidance subsystem **870**, would make extensive use of Maps and Databases **620** and GPS **610** subsystems in the event of an accident. For 5 instance, Collision Avoidance subsystem **870** might, through some combination of events, detect that an accident that is likely to cause injury or death is imminent. In that case, rather than waiting for the accident to actually occur, Onboard Computer **20**, using 10 one of Communications/Interface **500** subsystems, either Cellular/PCS **520** or Satellite Com Link **510**, can place an emergency call to the fleet dispatcher, to the vehicle's home or possibly to the local authorities, such as a 911 emergency call. In that way, once the accident actually 15 occurs and the vehicle becomes inoperable, including Onboard Computer **20**, a distress signal has already been issued by Onboard Computer **20**. If, on the other hand, the accident which was determined by Onboard Computer **20** to be imminent does not occur, or the severity of the 20 accident is limited, the user may merely cancel the imminent distress call.

Of course, under ordinary use, vehicles tend to break down or have mechanical difficulties of one type or another; and somehow, the likelihood is that, when that 25 occurs, the vehicle operator will not have a clear idea of the vehicle's location within a particular driving area. By using the integrated Navigation and Tracking system **600**, the vehicle operator can quickly determine the vehicle's location at the time of the incident and,

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using Communications/Interface system **500**, call either a dispatcher, mechanic or a service company for aide.

In other embodiments, performance limits may be adjusted to limit the maximum distance a vehicle is 5 authorized to travel from its home base or in deviation from a predetermined route of travel. Working in combination with Safety system **800** and Engine Performance system **900**, Warnings, Gauges and Lights subsystem **830** uses visual or audio indicators to gently remind the 10 vehicle operator that the limits of travel are being exceeded (see **Figure 8**). Finally, when the infraction becomes critical, the vehicle is gently caused to come to a stop by reducing the maximum vehicle speed parameter 15 limit which reduces the vehicle's speed using Vehicle Speed subsystem **920**, **Figure 9**.

However, prudent safety operation dictates that the vehicle should always be allowed to move very short distances, such as one hundred feet, just in case the vehicle operator becomes de-authorized at a point which 20 is unsafe, such as a railroad crossing. This gives the de-authorized operator an extra measure of distance to travel.

Finally, a user may be restricted from operating the vehicle further than a certain number of miles from its 25 home to reduce unauthorized trips and joy riding. A regular route vehicle may be limited to a prescribed route of travel and any variation might be strictly prohibited. However, in most instances the parameters

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are not so strict as to allow the vehicle to be maneuvered around detours.

Figure 7 illustrates another system under the control of the onboard computer, the audio system.

5 Another onboard system which would be particularly convenient for multiple vehicle users would be Audio system **700**. Audio system **700** connects to Onboard Computer **20**, which restricts access to users who do not possess the required security level. Users such as

10 parking attendants and the like who may be required to operate the vehicle only for short distances, are not expected to use the vehicle's audio system. Audio system **700** would allow each operator to select preferred AM/FM radio stations, compact disks or tape selections for

15 listening. In addition, it would allow the individual users to select unique preferences for volume levels, tone and other audio quality settings. Audio system **700** contains: Volume subsystem **710** for adjusting the volume of Audio system **700**; Balance subsystem **720** for adjusting

20 the balance between left and right outputs of Audio system **700**; Fade subsystem **730** for adjusting front and rear outputs of Audio system **700**; and Tone subsystem **740** or comparable subsystem for adjusting the frequency response or spectral response of the outputted sound.

25 Audio system **700** may also include Selector **750**, which selects the user specific devices such as CD, tape, AM/FM radio or other possible outputs. Audio system **700** may also contain CD/Tape Carousel **760**, which stores a variety of CDs or tapes on a ready-to-use basis, allowing the

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user to merely select from an available selection in CD/Tape Carousel **760** rather than having to reload CDs or tapes. Finally, Audio system **700** could include AM/FM Station Frequencies subsystem **770**, which includes the 5 user's preferred station settings, along with possible station types and a menu of stations in the vehicle's area.

Audio system **700** works in a fashion similar to the other systems in that the user is identified to Onboard 10 Computer **20** via User Interface **28**. Once the computer recognizes the user, the computer then accesses audio preferences which can be stored in computer Memory **22**. Those preferences are then transmitted to Audio system **700**.

15 Pre-stored user specific preference settings for volume, balance, fade and tone of the outputted audio adjust the various subsystems such as Volume subsystem **710**, Balance subsystem **720**, Fade subsystem **730** and Tone subsystem **740**. In addition, user-defined preferences 20 stored in Memory **22** would determine which output device the user has chosen to listen to and transmit that information to Selector **750**, which then activates the appropriate device, either radio or CD or tape. Once that device is activated, it in turn accesses the tape 25 and selection or CD and selection from the CD/Tape Carousel subsystem **760** or the AM/FM Station Frequencies subsystem **770** and plays the appropriate selection which the user has predefined and stored in Memory **22**.

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In addition, as the user operates the vehicle, Systems Monitoring system **290** continually monitors manual adjustments by the user to each one of these subsystems. Those adjustments can be used to update the user 5 preferences in the onboard system Memory **22**. When the user exits the vehicle, these preferences may be used to replace the previous user specific preferences stored in Memory **22** or may merely be decimated in favor of the pre-stored user specific preferences in Memory **22**.

10 **Figure 8** illustrates Safety system **800** as implemented in the present invention. Safety system **800** is contained within the dashed lines of **Figure 8**. Safety system **800** of the present invention is authorized only for higher security level users than the systems 15 discussed thus far. Therefore, as the user accesses Onboard Computer **20** via User Interface **28**, the user ID supplied by the user is ascertained by Onboard Computer **20**. The user ID is then compared to a list of IDs to ascertain the level of security that is authorized for 20 the user associated with this particular ID. Again, as in the other systems described above, Onboard Computer **20** would then authorize the user's ID number and retrieve user specific parameters from system Memory **22**. The user is granted access to Safety system **800** only if the user 25 is authorized for a higher level of security than the normal user. Therefore, Onboard Computer **20** will only grant control of Safety system **800** to users possessing a master or higher level of security authorization. The user specific parameters would be accessed and applied to

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the various subsystems within Safety system **800**. Safety system **800** contains various subsystems which relate to the safety of the vehicle. Those subsystems include: Airbags **810**; Antilock Braking **820**; Warnings, Gauges and 5 Lights **830**; Passenger Restraints **840**; Exterior Lights **850**; Spark and Fire Abatement **860**; and Collision Avoidance subsystem **870**.

In one embodiment, Airbags **810**, may be either enabled or disabled depending upon the user's preferences 10 or safety needs. For instance, in normal user mode all of the airbags in the car would be active. However, certain users with access to the necessary security level may disable certain airbags via Airbags subsystem **810**.

In cases where a parent always drives with a young child 15 in a car seat, the airbags adjacent to the car seat might be disabled by setting the appropriate user specific preferences. Alternatively, the user or certain passengers might be of such slight stature that deployment of the airbags may be more hazardous than the 20 accident itself, especially in a low-speed accident. In that case, that user may prefer to disable one or more of the airbags in the passenger compartment via Airbags subsystem **810**.

Other preferences might disable antilock braking for 25 certain users via Antilock Braking subsystem **820**. Also, Warnings, Gauges and Lights subsystem **830** may have preferences as far as warning defaults and the like, to be set depending on the user's preferences. These may consist of configuring graphic displays to setting

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warnings messages as either visual, text, voice or audio warnings. Passenger Restraints subsystem **840** might be set to require all passengers to be fully restrained before the vehicle will move. One method of implementing this requirement totally within Safety system **800** would be for vehicle Antilock Braking subsystem **820** to engage the brakes, thereby prohibiting the vehicle from moving until all passengers are fully restrained.

Other subsystems include Exterior Lights subsystem **850**, which monitors and controls the exterior lights. Therefore, when an exterior light burns out or is damaged, Systems Monitoring system **290** immediately communicates the status to Onboard Computer **20**, and the information is conveyed to the user via User Interface **28** or through Warnings, Gauges and Lights subsystem **830**.

Another subsystem important to safety is Spark and Fire Abatement subsystem **860**. While most terrestrial vehicles possess only minimal spark and fire subsystems, aircraft and marine vehicles require more sophisticated spark and fire abatement subsystems because of the lack of alternatives to operators of non-terrestrial vehicles.

Another subsystem important to the safety of operation is Collision Avoidance subsystem **870**. Because collision avoidance is one of the most rapidly changing safety items on a vehicle today, even more advancement in the area of collision avoidance is expected in the future. A collision avoidance subsystem may be further partitioned into front and rear subsystems or even into xyz direction subsystems for vehicles that do not travel

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along a plane. In one embodiment, Collision Avoidance subsystem **870** is linked inexorably to Antilock Braking subsystem **820**, Passenger Restraints subsystem **840** and Airbags subsystem **810**. In addition, Collision Avoidance subsystem **870** is connected to Communications/Interface system **500**. Collision Avoidance subsystem **870** will continually monitor the vehicle's position with respect to the positions of all other vehicles and obstacles in the proximity of the vehicle. Once the possibility of a collision is detected by Collision Avoidance subsystem **870**, Collision Avoidance subsystem **870** attempts to warn the operator through Warnings, Gauges and Lights subsystem **830** using audible and visible alerts intended to make the operator aware that a collision involving this vehicle is likely.

At some point before an imminent collision, Collision Avoidance subsystem **870** may act autonomously to avoid the collision. For instance, Collision Avoidance subsystem **870** may set the antilock brakes via Antilock Braking subsystem **820**. Collision Avoidance subsystem **870** may also communicate to the local authorities via Communications/Interface system **500** that a collision involving the vehicle is likely or imminent. Collision Avoidance subsystem **870** may also allow airbags to deploy faster by using Airbags subsystem **810** in combination with Collision Avoidance subsystem **870**. Then, rather than relying on the airbags to deploy in response to impact sensors along the bumpers and sides of the vehicle, the user modifies the user specific parameters associated

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with Collision Avoidance subsystem **870** to deploy the airbags when the vehicle reaches a threshold proximity to the obstruction. Therefore, rather than the airbag being triggered by a certain amount of front or rear-end deformation of the vehicle, the airbag deployment is triggered just before the vehicle impacts with the obstruction, thereby saving valuable milliseconds in deployment. Also, changing the user specific parameters to deploy airbags sooner allows for lower speeds of acceleration within the airbags, which has been determined to be advantageous to smaller and lighter users and passengers.

Another embodiment of the present invention, Theft Deterrence and Recovery subsystem **210**, might be connected with both Antilock Braking subsystem **820** and Exterior Lights subsystem **850**. This combination would allow Theft Deterrence and Recovery subsystem **210** to activate certain exterior lighting configurations and/or antilock brakes at certain times during a vehicle theft. In one example, the user may pre-set certain user specific parameters that would allow a vehicle theft to occur only in certain places. For instance, it might be that the user would allow the vehicle to be stolen from the user's home but not the user's place of business. This is an important safety consideration, being that there is a likelihood of violence occurring during a frustrated theft attempt. Therefore, in attempt to avoid frustrating a potential vehicle thief at the user's home, the user may elect to allow the vehicle to be stolen and then alert the local

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authorities via Communications/Interface system **500**. In addition, Theft Deterrence and Recovery system **210** could reconfigure certain exterior lights that are not visible to the present unauthorized operator. For instance, a 5 vehicle that is being operated by an unauthorized user might be configured to flash one exterior brake light each time the brake pedal is pressed. Therefore, authorities witnessing a flashing rear brake light might have reasonable suspicion to stop such a vehicle and 10 inspect it. In another embodiment, the Antilock Braking subsystem **820** may be set to trigger the brakes upon the unauthorized user traveling one or two miles from the user's home. In that case, the vehicle would become completely inoperable and the unauthorized user would 15 hopefully abandon the vehicle. Thus, the vehicle would be available for safe recovery.

Figure 9 illustrates Engine Performance system **900** as related to the present invention. Like Safety system **800**, Engine Performance system **900** requires higher level 20 security for authorization by Onboard Computer **20**. User preferences are stored in Onboard Computer **20** system Memory **22** just as in the cases described above. Engine Performance system **900** consists of several possible subsystems, including Engine RPM (i.e., revolutions per 25 minute) subsystem **910**; Vehicle Speed subsystem **920**; Vehicle Acceleration subsystem **930**; Engine Emissions subsystem **940**; Fuel Miser subsystem **950**; and Load/Altitude Adjustment subsystem **960**. Once the user is identified to Onboard Computer **20** via User Interface **28**,

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Onboard Computer **20** analyzes the user ID to ascertain the user's security level.

If the user has a sufficiently high security level, as authorized by Onboard Computer 20, then the user may 5 reset the user specific parameters for the engine performance subsystems in Engine Performance system 900. It would be conducive to safe operation of the vehicle for certain users who do not possess the necessary skill, age or expertise to operate the vehicle safely, to be 10 limited by the vehicle's performance. One way to limit the vehicle's performance is by limiting or restricting the engine's RPM via Engine RPM subsystem 910. The engine might only be allowed to rev up to a certain level, say 4000 RPMs. Such a limitation would be 15 advantageous where there is a possibility that a younger user might have the tendency to race an engine at a stoplight or in a garage to extremely high RPM levels which could damage the interior components of the engine. Another important aspect of the present invention is 20 limitation of the vehicle's speed via Vehicle Speed subsystem 920. Invariably, speed is an important factor in both the frequency and severity of on-the-road accidents. By limiting the vehicle's speed for novice users, the number and severity of these accidents can 25 possibly be decreased. This is also an important concept for vehicles other than on-the-road vehicles, such as airplanes and marine vehicles.

Vehicle acceleration is another important component of a vehicle safety program. If vehicle acceleration is

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limited via Vehicle Acceleration subsystem **930**, the user can only accelerate the vehicle at a certain rate. This reduces the likelihood that younger users who enjoy the fast take-off from a red light or stop sign would

5 participate in such activities. In the case of other vehicles, such as aircraft and marine vehicles, vehicle acceleration may also be measured in deceleration.

Extremely rapid deceleration in an airplane or boat can cause the vehicle to become unstable. For instance, in

10 an aircraft extremely rapid deceleration may cause the aircraft to flip or go into a spin that is not recoverable because the vehicle's forward momentum has been lost. Extremely rapid deceleration of a boat causes a wake of water to come over the stern of the boat, thus 15 swamping the vehicle. Therefore, extremely rapid deceleration in aircraft or marine vehicles is highly undesirable.

Another subsystem controlled by Engine Performance system **900** is the Engine Emissions subsystem **940**. While

20 Engine Emissions subsystem **940** would generally be inaccessible to the vehicle's operators, it might be advantageous to reduce engine emissions even further below the Environmental Protection Agency (EPA) recommended standards. Therefore, on certain days such 25 as smog alert days and the like, engine emissions may be set to an even stricter standard via Engine Emissions subsystem **940**. Clearly this would have a detrimental effect on the performance of the vehicle and would not be appreciated by certain users. In a similar manner, Fuel

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Miser subsystem **950** may be set to require the vehicle's overall performance to maintain a certain vehicle fuel mileage. Although the vehicle operator may be allowed one or two quick accelerations, thereafter the

5 performance of the vehicle would be strictly limited to make up for those accelerations and maintain the overall fuel efficiency of the vehicle.

Finally, Engine Performance system **900** contains Load/Altitude Adjustment subsystem **960**. Load/Altitude

10 Adjustment subsystem **960** would change the engine's performance depending upon the altitude of the vehicle and the load the vehicle is carrying. Thus, when the vehicle is heavily loaded, as in the case of a truck pulling a boat, the vehicle performance characteristics 15 would change from being a faster or faster accelerating vehicle to that of being a vehicle that is more adept for towing, especially up hills, boat ramps and the like. This, of course, would be at the expense of other performance characteristics in the subsystem.

20 As in Safety system **800**, Engine Performance system **900** would be inexorably linked to Theft Deterrence and Recovery subsystem **210**. Once Theft Deterrence and Recovery subsystem **210** detected an unauthorized user, the engine performance parameters stored in Memory **22** would 25 set Engine Performance system **900** to levels that would make the vehicle inoperable. For instance, Vehicle Speed **920** parameters might be set to limit the vehicle to zero speed, and Engine RPM subsystem **910** might be set to limit the engine to zero RPM. Also, Vehicle Acceleration

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subsystem **930** could be set to zero. Thus, the vehicle's engine would be rendered inoperable.

The process of the present invention as described with respect to **Figures 1 to 10**, will now be discussed 5 with respect to **Figures 11 to 13**.

Another important aspect of the present invention is how the user interfaces with Onboard Computer **20**. **Figure 10** illustrates the user interface system as implemented in the present invention. User Interface system **28** may 10 employ a variety of different subsystems, singularly or in combination with each other. One of the exciting new concepts to be available involves SmartCard **1015** and SmartCard Reader **1010**. SmartCards are well known in the industry and will not be described in detail here; but 15 for the purpose of this invention, SmartCard **1015** contains at least Memory **1016** which is read by SmartCard Reader **1010**. When a user enters the vehicle, the user is identified by swiping SmartCard **1015** in SmartCard Reader **1010**. Onboard Computer **20** recognizes the input from 20 SmartCard Reader **1010** and accesses Memory **22** for information concerning the user. In one embodiment, Onboard Computer **20** merely checks the data available from Memory **1016** on SmartCard **1015** with the data for the particular user stored in onboard system Memory **22**. In 25 other embodiments, Onboard Computer **20** works in concert with a processor (not shown) on SmartCard **1015** in a series of ID verification steps designed to authorize the user.

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Another advantage of SmartCard **1015** is that SmartCard Memory **1016** may contain other than merely numeric data. Memory **1016** may include all data pertaining to the owner of the SmartCard, including all 5 user specific preferences applied in setting the various functions and sub-functions of the vehicle. Memory **1016** might also include user identification data such as the user's fingerprint pattern, the user's voice print pattern, the user's iris print pattern or the user's 10 handwriting pattern. In one example, the card could actually initiate the authorization process via Onboard Computer **20**. The user would then be required to confirm identity on a second user interface, such as Fingerprint Reader **1020**.

15 Importantly, SmartCard Memory **1016** can be used to store user specific parameters for one vehicle or for several vehicles. In that same way, Memory **22** may store the user specific parameters for all users authorized to operate the vehicle.

20 System fraud and vehicle theft could be greatly reduced if the intended user who has authorized SmartCard **1015** could also be confirmed as the actual operator of the vehicle. The surest way to achieve this goal is to register some biological attribute of the user with the 25 vehicle interface. The most widely used biological attribute that identifies users is their picture. The second most useful, and probably the easiest for an onboard system to analyze, would be a user's fingerprint. In another embodiment of the present invention, once

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SmartCard **1015** is read by SmartCard Reader **1010** and authorized by Onboard Computer **20**, the user is then required to input User's Finger **1025** via Fingerprint Reader **1020**. Onboard Computer **20** then compares the 5 user's fingerprint pattern to either a fingerprint identified with the user's data stored in onboard Memory **22** or stored on SmartCard Memory **1016**. Once the user has been identified by Onboard Computer **20** as the rightful possessor of the SmartCard **1015**, Onboard Computer **20** then 10 allows the user to access the highest level of security authorized within Onboard Computer **20**.

Verification of a user's ID may be accomplished by a number of other means, including Touch Pad **1060** or Number Pad **1070** via Graphical User Interface (GUI) **1080**. While 15 GUI **1080** is advantageous, it is not essential to practice the present invention. In fact, GUI **1080** may include Touch Pad **1060** or it may not, or it may include Number Pad **1070** or it may not, or any one of the three could be used in combination. In another embodiment, the present 20 invention may require user identification via a voice print stored in system Memory **22** or on SmartCard **1015** Memory **1016**. In that case, User Interface system **28** includes Microphone **1030**. The user interfaces with the system by inputting User's Voice **1035** to Microphone **1030** 25 and then Onboard Computer **20** compares the voice pattern with that of the user's voice pattern stored in system Memory **22** or SmartCard **1015** Memory **1016**.

Other possible means of verifying the user's identity include the user's iris pattern. In this case,

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CCD Camera **1040** would input an image of User's Eye **1045** to Onboard Computer **20** for analysis and comparison with an iris pattern stored in system Memory **22** or on SmartCard Memory **1016**. In another embodiment, User

5 Interface **28** might include a sample of the user's handwriting within system Memory **22** or within SmartCard Memory **1016**. The user would input a pre-determined sentence or series of words on Touch Pad **1060** as directed by the output of GUI **1080**. Onboard Computer **20** then
10 compares that series of slashes and gestures with the pattern stored in system Memory **22**.

In another embodiment of the present invention, the user is merely required to enter the proper personal User's PIN **1075** via Number Pad **1070**. Although generally

15 the personal identification number is an unchanging number that the user always possesses, recently and with the advent of GUIs, the personal identification number is more than merely a number. For instance, the personal identification number can actually be an operation the user applies to a number, or an 'algorithmic password.' An example of an algorithmic password is to display a number to the user, such as '1234,' via GUI **1080**. An algorithm known only to the user might be to subtract each of the outside digits from 10 and transpose the two
20 inner digits. Thus, in response to seeing the number '1234,' the user inputs the number '9326' on GUI **1080**. Even someone watching the user input that number would have no idea what algorithm the user applied to the
25 display number, as the operation is known only to the

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user. More complicated algorithms can be formulated to test the dexterity of the user. Such dexterity tests are well known as effective in deterring intoxicated users and users who are incapable of safely operating a vehicle 5 due to lack of sleep or illness.

In the final embodiment, User Interface **28** may include Breathalyzer **1050** to test User's Breath **1055** for alcohol content. A user that has been prone to drive while under the influence of drugs or alcohol would be 10 required to demonstrate sobriety before being allowed to operate the vehicle. In this case, User's Breath **1055** can be analyzed by Onboard Computer **20** to detect the presence of known intoxicants. The user may be given several opportunities to pass the breathalyzer test 15 before the user is de-authorized and the vehicle is disabled by Onboard Computer **20**.

Finally, a user possessing a sufficiently high security level, such as a master user or an administrator, may authorize subsequent identification 20 verification by proxy, thereby allowing access to certain onboard systems by users which have been denied access on a verification basis. This is an important feature for resolving identification verification problems brought about by failure of an identification verification 25 subsystem.

An important aspect of the present invention is that one or all of these identification verification subsystems can be included in User Interface system **28**. The advantage of SmartCard **1015** is that it contains

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Memory **1016**, which can be updated and obliterated while not in contact with Onboard Computer **20**. Unlike onboard computer Memory **22**, SmartCard **1015** can be read and

5 while the vehicle is not even in the user's possession.

Therefore, the user specific preferences stored on SmartCard Memory **1016** can be updated by someone other than the user, placing the user at the mercy of the fleet dispatcher or vehicle owner or parents, or whomever is ultimately responsible for the vehicle. Also, the SmartCard might contain user preferences for a variety of different vehicles.

Alternatively, SmartCard Memory **1016** contains user specified parameters in an independent device format. By

15 using an independent device format for storing user
specified parameters, the user may set specified
parameters which are desired for use by a variety of
different vehicles and vehicle types. The device-
independent parameters would then be transformed into
20 device-dependent parameters by the onboard computer of
any vehicle in which the SmartCard is inserted. While
some parameters may require some fine tuning or tweaking
once the user becomes accustomed to each different
vehicle, the majority of the user specified parameters
25 will fulfill the user's expectations without tweaking.
Tremendous memory savings are achieved by storing user
specific parameters in device-independent format on the
SmartCard. Rather than storing multiple sets of user
specific parameters on a variety of different vehicles,

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the one set of user specified parameters which is stored on the SmartCard is transformed into device-dependent parameters by any onboard computer of a specific vehicle into which the SmartCard is inserted.

5 **Figure 11** depicts another embodiment of Audio system 700 as defined by the present invention. In **Figure 11**, Audio system 700 is further divided into various subsystems of the present invention which were delineated in **Figure 7** as Volume subsystem 710, Balance subsystem 10 720, Fade subsystem 730, Tone subsystem 740 and Selector subsystem 750 and which are now combined in Audio Output Control subsystem 775. In addition, the present invention now includes Audio Event Programming subsystem 780, Audio Event Scheduling subsystem 785, Audio Event 15 Retention subsystem 790 and Audio Event Memory subsystem 795. Audio system 700 still contains CD/Tape Carousel subsystem 760 and AM/FM Station Frequencies subsystem 770.

The process of the present invention is illustrated 20 in **Figure 12**. The process starts at step 1205. The user enters the user's ID via Touch Pad 1060 of GUI 1080 or Number Pad 1070 of GUI 1080. Alternatively, the user may swipe SmartCard 1015 into SmartCard Reader 1010 (step 1210). A menu of the available audio programs is then 25 displayed to the user via User Interface 28 (step 1215). In one embodiment of the present invention, the user is then required to enter the radio frequencies or call signs of the radio stations the user requires the system to scan for the audio events to be acquired in later

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steps (step **1220**). The user then prioritizes the radio events which are to be recorded or memorized by topic (step **1225**). The topics that are to be recorded are then further prioritized by title (step **1230**). Alternatively 5 or additionally, rather than selecting audio events by topic and by anticipated title and having the radio automatically scan frequencies for airings of those events, the user may select the specific title of a preferred radio program (step **1235**). The user may then 10 enter the radio frequency and the time that this program will be aired (step **1240**). The user may then select other titles (step **1250**) by repeating the process at step **1235** until no other titles are to be selected. This type 15 of programming is similar to programming a VCR to record favorite television programs. The process then passes control to step **1260** where the user may store the settings, indexed by the user's ID (step **1260**). If the user is unhappy with the settings the user may return to step **1215** and repeat the process. On the other hand, if 20 the user is happy with the selections the process ends at step **1270**. While the process illustrated in **Figure 12** is similar to that of programming VCR recordings, generally the user plays back VCR recordings at leisure so no playback mode specifications are necessary.

25 In **Figure 13A**, the process starts at step **1300**. At step 1305, the user enters a unique user ID or user SmartCard as described above with respect to **Figure 12**. GUI **1080** displays the user menu at step **1310**. Next, the user is required to prioritize the playback scheduling of

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radio events by topic (step 1320). This information is used by Audio Event Scheduling subsystem **785** for scheduling audio events by topic. The user then prioritizes the playback scheduling of topics by title

5 (step 1330) and Audio Event Scheduling subsystem 785 uses
this information to further refine the schedule of
playback for this specific user.

The user is then required to prioritize the retention of radio events by topic (step 1340).

10 Prioritizing the retention of radio events enforces a strict regimen that deletes lower priority information stored in Audio Event Memory subsystem **795**. Certain events are more important to certain users than other events that may nonetheless be more important than yet other events. For instance, a current weather forecast is extremely important topically as are certain news broadcasts. However, a weather forecast is no longer current and therefore of virtually no importance the following day, especially when taken from the perspective of the vehicle operator whose objective is to navigate through current weather conditions. Therefore, in one example, weather forecasts would be retained only as long as they are current and automatically overwritten by the next available weather forecast. In the case of news broadcasts, on the other hand, the system may retain two or three previous news broadcasts along with the current news broadcast or, in other embodiments, the user may select to retain only the most recent news broadcast. Other programs, such as information programs, may be

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retained for a number of weeks. For instance, an event that airs weekly, such as a political round table talk, might be current but also still useful some weeks after the time it is aired and, therefore, might remain in

5 Audio Event Memory **795** for several weeks. Other radio event topics, such as home improvement, self improvement, panel discussions or vehicle maintenance, might remain in Audio Event Memory **795** much longer even if they are not particularly topical but are designated as relatively

10 important to a particular user. The user is then required to prioritize retention of the topics by title (step **1350**). Therefore, within a certain topic, such as car repair, the user may have several radio programs to select from within a week's time. The user may

15 particularly care for one or two of the programs and yet not care for the rest of them. Conveniently, the system would prioritize programming depending on the user's preference by title.

Although other implementations of the present

20 invention are possible, it is important to note that this system gives the user extreme flexibility in both recording a particular program and playing back that particular program. For instance, if the user especially cares for a particular child development panel discussion

25 program that is aired at a certain time and does not particularly care for a second child development program that is aired at a different time, the user can prioritize the recording of these two events as illustrated in **Figure 12**. If the program the user enjoys

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is not aired or cannot be recorded, the system may still record the second program. Then in playback mode, if the user enjoys the topic of child care over any other topic of radio program, even though the user's favorite child care program has not been recorded, the system may schedule in its place the playback of a child care program having a lower priority.

Next the user selects a playback format for radio broadcast events by topic (step 1360). This selection is 10 performed by the Audio Event Programming subsystem 780. The user then selects the playback format of particular topics by title (step 1370). Next the user is asked whether or not the settings should be stored by user ID. If the user is unhappy with a selection, the process 15 returns to step 1320 to reinitialize the system (step 1380). If the user's selections are acceptable the process ends at 1390.

Figure 13B illustrates the playback mode of the present invention in more detail. Steps 1300 to 1310 20 correspond to steps 1205 through 1215 of the previous illustration in **Figure 12**. The user prioritizes the playback scheduling of radio events by topic at step 1320. The user then selects the playback topic priority scheduling, such as immediate, important, informational, 25 entertainment or on-demand, in order to prioritize the scheduling of a specific topic (step 1325). The process then returns to step 1320. If no further prioritizing is requested by the user, the process passes to step 1330. There the user prioritizes playback scheduling of topics

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by title by ranking the particular titles within a topic on some scale (between 1 and 100 is exemplary) (step 1335). The process then passes back to step 1330. If no more titles are requested to be prioritized, the process 5 passes to step 1340 where the user prioritizes the retention of radio events by topic. If the user intends to select topic retention, the user specifies the number of hours the topic should remain resident in Audio Event Memory 795 (step 1345).

10 Once the retention rankings of all topics have been selected and the number of hours the topics should remain resident in memory have been determined, the system passes the process back to step **1340**. If the user is satisfied with the selections for the retention of radio events by topic, the system then passes the process to step **1350** where the user is asked to prioritize retention of topics by title. If the user has a preference for certain titles within topics, the user may rank those titles as being permanent, store until played, store as current or store until playback (step **1355**). Thus, titles of topics remain in Audio Event Memory **795** only as long as the user intends and certain titles of topics may remain resident in Audio Event Memory **795** on a permanent basis or until the user intends to overwrite them.

20 Others remain in memory only until played automatically by Audio Event Scheduling **785** or until played manually by the user. Still other titles of topics stored as current are overwritten automatically when a new identical or similar broadcast is stored on the system memory. Still

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others are stored until playback, whether there is another identical or similar title of topic in memory or not. Once the user has prioritized title retention preferences, the process returns to step 1350. If no more topics are intended to be prioritized by title, then the system passes to step 1360.

At step 1360, the user selects a playback format of radio events by topic. If the user has a preference, the user selects a format of continuous playback,

10 discontinuous and replay playback, or discontinuous and pick-up playback (step 1365). For instance, a topic such as a panel discussion on child care might be assigned a format of discontinuous and pick-up. Thus, when the user is listening to the selected topic, if a news or
15 information topic or title is recorded by Audio Event Programming system 780, the child care panel discussion may be interrupted for presentation of the information broadcast. Once the information broadcast is completed, the child care program will pick up where it left off.
20 Alternatively, the user may select to hear an entire program in one sitting. In this case, if a program having a higher scheduling priority is received by Audio system 700, the ongoing program is interrupted for airing of the higher priority program and then, rather than
25 being picked up from where it was interrupted, the initially airing program is replayed from its beginning. Other formats are possible; the above-mentioned formats are merely exemplary.

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Once formats are selected, control is passed back to step **1360**. If no more playback formats are to be selected by topic, control is passed to step **1370**. The other playback format of topics is selected by title. At 5 step **1375**, the user may select to re-rank certain titles within a particular topic by designating a playback format different from the entire topic. For instance, higher priority events within the topic might be selected to be played back as continuous rather than in some type 10 of discontinuous mode. Thus, while the topic playback format might be designated as discontinuous and replay mode, one or more of the radio events that are more significant to the user might be selected for a continuous playback format. Once the user has selected 15 all of the playback formats by title, control is passed back to step **1370**. If no more formats are selected, control is passed to step **1380** where the user is asked to store the selected index by user ID. If the user is not happy with the selections, control is passed back to step 20 **1320** for re-initialization of the process. Alternatively, because the entire menu is being displayed on GUI **1080** the user may select any step for modification and return then to step **1380** to store the user settings indexed by the user's ID. Once that is complete, the 25 process ends at step **1390**.

An important feature of the present invention is that, while a vehicle remains idle, Audio Event Memory **795** may be continually updating broadcast programs specified by the user. The vehicle could also be

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connected either to the fleet control via Fleet Docking Port **540** or the user's home via Home Docking Port **560**.

This is extremely convenient for a user on a limited time schedule. One example is the daily rush of the typical

5 commuter. Often the operator of the vehicle spends five, ten or fifteen minutes of the morning routine catching up on news, weather and traffic reports in order to plan a route to the office or business. A system such as the present invention, which automatically records these

10 reports and plays them back immediately upon the user entering the vehicle, may save the user that five to fifteen minutes early in the morning. Thus, when a user enters the car and is identified to Onboard Computer **20**

via User Interface **28** by inputting a user ID number or 15 SmartCard as in step **1305**, the user is automatically greeted by the local traffic report, news and weather.

Thus, almost before exiting the driveway, the user has a good idea of what travel route is best at that time.

Such immediate availability of these reports is even more 20 crucial for operators of vehicles other than cars or trucks. For instance, light aircraft and marine vehicles

are particularly susceptible to changes in weather. In alternative embodiments of the present invention, news, weather and traffic reports can be integrated with 25

Navigation and Tracking system **600**, and a travel route for the vehicle automatically determined before the user even enters the vehicle.

Finally, vehicle operators who are routinely required to traverse long distances will have a steady

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stream of current and topical information from which to select. As the vehicle moves into and out of broadcast coverage areas, the vehicle itself contains a menu of programming that the user has pre-selected in Audio Event

5 Memory 795. Therefore, rather than the user manually switching stations or flipping back and forth from CD to radio, or merely changing tracks and titles on the CD, tape and radio, these events are programmed and prioritized by the user in order to give the user the
10 best combination of topics and titles available.

In still other embodiments of the present invention, the user may selectively reduce the amount of content in any one event, topic, or titles within the topics. For instance, the user may select to have a particular

15 program recorded by Audio Event Memory **795**, commercial
free. Audio Event Programming **780** identifies commercials
during the program and switches off Audio Event Memory
795 during the airing of the commercials. In other
embodiments, Audio Event Programming **780** may selectively
20 compress certain audio events. Thus, the playback length
of certain events, such as panel discussions, may be
reduced by 10 percent or so from the original broadcast
length. While the user may notice some increase in pitch
of the voices of these panel participants, the overall
25 audio quality would be acceptable.

In a final embodiment of the present invention, the program retention and playback formats are indexed by user ID. Audio Event Memory subsystem **795** must contain enough space for several users. As a user enters the car

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and is identified by Onboard Computer **20**, the user's audio preferences are acquired from system Memory **22** and implemented through Audio system **700**. It is assumed that every user would have a unique set of preferences and 5 very little overlap among users would occur. Therefore, at some point, especially if a number of different users operate the same vehicle, Audio Event Memory **795** would become full. In a further embodiment, the users would be prioritized. For instance, a user having a master 10 security level would be able to rank the priority of other users. This could be done in a number of different ways. For instance, high level users may have complete priority over other users. Thus, if Audio Event Memory **795** is completely filled with programming events selected 15 by the master level user, no memory would be available for other users. Alternatively, each user may be assigned a pre-defined section of Audio Event Memory **795** to be filled in any manner desired.

Finally, each user may be authorized to store only 20 events having high playback priority. Thus, topics having immediate and important priority for each user may be automatically given priority over any user's lower priority playback scheduling parameters. Thereby, the most important programming for each user would be 25 guaranteed available when the user enters the vehicle.

Figure 22 illustrates the audio data structure implemented in the present invention. In a preferred embodiment of the present invention, an audio data structure **2200** is stored in a memory. The audio data

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structure may be indexed to the user and stored in computer Memory **22**. Alternatively, audio data structure **2000** may be stored on a user's SmartCard in Memory **1016**

5 700. Audio data structure **2000** may be displayed on GUI
1080 or may be resident in one of the memories described
above. Audio data structure **2200** is meant as an example
of one possible embodiment and is in no way meant to
limit the practice of the present invention. Audio data
10 structure **2200** is broken down into several column groups:
broadcast event identification (group **2202**); a group of
record preferences (group **2204**); playback scheduling
preferences (group **2206**); memory retention preferences
group (group **2208**); and playback format preferences group
15 (group **2210**).

Audio data structure 2200 is compiled by using the process described with reference to **Figures 12** and **13** described above. In the present invention, header row 2212 identifies the contents of each of the columns.

20 Rows **2214** to **2226** illustrate the individual broadcast events. Example row **2214** illustrates a news topic identified in column **2213**. Column **2215** is blank, noting that no title is to be given for the news. Therefore, the user must either designate a frequency, and time and 25 day to record the topic, or the user may provide a variety of frequencies or call signs which the system can scan to locate the topic designated by the user.

Returning to row 2214, the user designates the frequency from which the program will be recorded. In

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this case, frequency **2217** is indicated as 590 AM. Other record preferences **2204** include time **2221** and day **2219** of the broadcast event airing. In the case of row **2214**, the user has indicated to record Monday through Friday from five minutes to ten minutes past the hour (columns **2219** and **2221**, respectively).

Next, the user indicates the playback scheduling preferences from playback scheduling group **2206**.

Preferences generally correspond to the topic or title of the program. In this case, the user has selected only a topic, so the user then designates playback topic priority **2223**. In this case, the user has entered 'important.' Playback title priority **2225** remains blank because the user has not indicated a specific title.

15 Next, the user indicates retention parameters from
retention preferences group **2208**. First, the user enters
the length of time for which a broadcast should be
retained in memory. Again, priorities are generally
based on topic and then title of the broadcast event. In
20 the case of row **2214**, the news topic will be held for a
maximum of ten hours as indicated in topic retention
priority column **2227**. Again, title retention priority
2229 is blank because no title was indicated by the user
in title field **2215**.

25 The user can then designate number of copies to be
retained **2221**. In this case, only one copy need be
retained. Therefore, as a new news broadcast is
received, it writes over the old broadcast. Finally, the
user designates memory stacking parameters **2233**. In this

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case, the user has designated mono as the memory stacking parameter. However, the user may designate a number of parameters. For instance, the user may intend to store the program in stereo mode, which takes up much more

5 memory space. Conversely, the user may intend to store the recording as a compressed mono with a compressability factor determined by the percentage of memory saved. For instance, mono compressed 20 would save approximately 20 percent of memory space over normal mono stacking mode.

10 Final preferences for the user to select are the playback format preferences from playback format group 2210. These preferences indicate how, or in what format, the broadcast event which is stored in memory will be played back. Playback topic format 2213 indicates that 15 the user selected discontinuous/pickup format. In this case, the news event will be played back. However, if the broadcast event is interrupted, making it a higher priority broadcast event, the broadcast event in 2214 will be picked up where it left off. Again, because no 20 title was specified, playback title format 2217 is left blank.

In another example, the user has selected a one-time event to be recorded on row 2226. In this case, topic 2213 is listed as a one-time event. Title event 2215 is 25 listed as 'Clinton.' The user selected frequency 2217 for 590 AM, day 2219 for Monday, and time 2221 of between 8:00 p.m. and 10:00 p.m. The user has selected President Clinton's State of the Union Address to be recorded. The user selected playback topic priority 2223 as on-demand.

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This means that, unless the user specifically calls up this broadcast event, it will remain resident in memory until overwritten by a higher priority broadcast event.

However, the user selected a relatively high playback

5 title priority **2225** of 5. Therefore, the chances of the Presidential address being overwritten by another program are relatively slight.

The user selected the topic for retention priority

2227 as 50 hours. Therefore, that topic will be stored

10 for 50 hours unless title retention priority **2229** contradicts topic retention priority **2227**. In that case, title retention priority will take precedence, and in this case, the user selected title retention priority **2229** as permanent. Therefore, the 50 hours selected on 15 topic retention priority **2227**, which will remain in force for other one-time broadcast event topics as well, will be circumvented by the selection of permanent for this particular title.

The user selected one as the number of copies to be

20 retained **2223** and selected a memory stacking algorithm **2213** of mono compressed by 10 percent. The user then selected discontinuous/pickup for playback topic format **2213**; but as in the retention group parameters, the user then selected playback title format **2237** as continuous 25 meaning that, although the general group will be played back in continuous/pickup format, this particular title will be played back continuously. Therefore, President Clinton's State of the Union Address will not be

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interrupted by another program event, no matter the priority, unless the user manually intervenes.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in a form of a computer readable medium of instructions and a variety of forms, and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media such as floppy discs, hard disk drives, RAM, CD-ROMs, and transmission-type media such as digital and analog communications links.

The description of the present invention has been presented for purposes of illustration and description but is not limited to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention and the practical applications, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular uses contemplated.